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(54) Title of the Invention: WOVEN AND KNITTED FABRICS

(57) Summary

Object: To provide polyester stretch woven and knitted fabrics having a combination of excellent comfort when worn, a high stretch and recovery from stretch, a soft yet resilient hand and an elegant luster which is not attainable in the prior art.

Solution: A woven or knitted fabric constructed of blended filament yarn composed of bicomponent filaments made of two polyester-based polymers bonded in a side-by-side arrangement in the lengthwise direction of the fiber, one of which components is a polyester that consists primarily of poly(trimethylene terephthalate) and the filaments have a linear density per filament in a range of 0.05 to 15 decitex; wherein the fabric has an average percent extension of at least 10% and an average percent recovery from extension of at least 70%.

SPECIFICATION

Claims

(1) A woven or knitted fabric comprised of a blended filament yarn composed of bicomponent filaments made of two polyester-based polymers bonded in a side-by-side arrangement in the lengthwise direction of the fiber, one of which components is a polyester that consists primarily of poly(trimethylene terephthalate) and the filaments have a linear density per filament in a range of 0.05 to 15 decitex; wherein the fabric has an average percent extension of at least 10% and an average percent recovery from extension of at least 70%.

(2) The woven or knitted fabric of claim 1, wherein the blended filament yarn composed of side-by-side bicomponent filaments is manufactured by spin blending.

(3) The woven or knitted fabric of claim 1 or 2 which is produced by spin blending filaments of a large single filament density at the center and filaments of a small single filament density on the outside layer.

Detailed Description of the Invention

[0001]

Technical Field of the Invention:

The present invention relates to woven or knitted fabrics having a comfortable feel when worn, a high softness and a high stretch.

[0002]

Because of their various outstanding mechanical and other properties, polyesters are being put to a broad and growing range of uses. Given the recent popularity of stretch apparel, there exists a desire to impart better stretch properties to polyester-based woven and knitted fabrics.

[0003]

In addition to the admixture of false-twisted yarn or elastomeric fibers, various side-by-side bicomponent fibers have been proposed as means for imparting stretch to polyester fibers. Side-by-side bicomponent fibers lack the roughness and excessive give of false-twisted yarn, and also do not have the inferior hand, drape and dyeability typical of blends containing polyurethane and other elastomeric fibers.

[0004]

For example, JP 44-2504 and JP-A 4-308271 describe side-by-side bicomponent yarns made of polyethylene terephthalates (abbreviated hereinafter as "PET") of differing intrinsic viscosity, and JP-A 5-295634 describes side-by-side bicomponent fibers which are composed of a non-copolymeric PET in combination with copolymeric PET having higher stretch. Although yarn having some degree of stretch can be obtained by using such side-by-side bicomponent fibers, when these yarns are rendered into a woven fabric, the fabric has inadequate stretch, making it impossible to obtain woven fabric of sufficient stretch. The reason is that prior-art side-by-side bicomponent yarns have a low

crimp developability when under constraint in a woven fabric or the crimps readily undergo permanent deformation when subjected to external forces. The stretch properties in such side-by-side bicomponent yarns are not attributable to stretch by the fibers themselves as in the case of polyurethane fibers. Rather, the stretch properties of such yarns rely on the stretch of three-dimensional coils that arises due to differential shrinkage between the constituent polymers. As a result, when the yarns are subjected to heat treatment while under constraint in a fabric that limits polymer shrinkage, the yarns become heat set in this state and lose the ability to shrink further, resulting in insufficient coil development and leading to the above problems.

[0005]

At the same time, in prior-art woven fabric made using side-by-side bicomponent fibers, even when some degree of stretch can be obtained, it has not always been possible to achieve a satisfactory hand. Woven and knitted fabrics of a low thickness in particular have a hard hand and poor drape properties, making them entirely unsatisfactory in ladies' blouses, one-piece outfits as well as outerwear and sportswear applications.

[0006]

One conceivable solution is to reduce the single filament linear density of the constituent yarn. However, the resulting fabrics have a uniformly limp hand, poor resilience and a tendency to crease, in addition to which they exhibit a shiny gloss rather an elegant luster.

[0007]

Problems to be Resolved by the Invention:

It is therefore an object of the present invention to provide polyester stretch woven and knitted fabrics having a combination of excellent comfort when worn, a high stretch and recovery from stretch, a soft yet resilient hand and an elegant luster which is not attainable in the prior art.

[0008]

Means for Solving the Problems:

To resolve the above problems, the polyester-based stretch fabric of the invention is constituted as described below.

[0009]

That is, the invention provides a woven or knitted fabric constructed of a blended filament yarn composed of bicomponent filaments made of two polyester-based polymers bonded in a side-by-side arrangement in the lengthwise direction of the fiber, one of which components is a polyester that consists primarily of poly(trimethylene terephthalate) and the filaments have a linear density per filament in a range of 0.05 to 15 decitex. The fabric has an average percent extension of at least 10% and an average percent recovery from extension of at least 70%.

[0010]
Mode for Carrying Out the Invention:

The woven or knitted fabric of the invention is described more fully below.

[0011]

Polyester-based side-by-side bicomponent fibers are used in the woven and knitted fabrics of the invention.

[0012]

Side-by-side bicomponent fibers are obtained by bonding together polymers of differing intrinsic viscosity, copolymerization ingredients, copolymerization ratios and the like, and develop crimp owing to differences between their respective elastic recovery properties and shrinkage properties. In the case of side-by-side bicomponent yarns in which the constituent polymers have different intrinsic viscosities, stress concentrates on the high intrinsic viscosity side during spinning and drawing, resulting in differing internal strain between the two components. As a result, the high-viscosity side undergoes a large amount of shrinkage due to differences in the percent elastic recovery following extension and differences in heat shrinkage during heat treatment of the woven fabric, giving rise to strain within individual filaments that causes the filaments to crimp in the form of three-dimensional coils. The diameter of these three-dimensional coils and the number of coils per unit filament length is for the most part determined by the difference in shrinkage (including the difference in elastic recovery) between the high-shrinkage component and the low-shrinkage component. The larger the shrinkage difference, the smaller the coil diameter and the greater the number of coils per unit filament length.

[0013]

Coil crimping in a stretch material is required to have a small coil diameter, a larger number of coils per unit filament length (that is, excellent extension characteristics and a good appearance), and good permanent set resistance in the coils (low degree of permanent deformation by coils and excellent retention of stretch properties when subjected to repeated stretch), and a low hysteresis loss during recovery from extension by the coils (excellent resilience and a good sense of fit when worn). By satisfying these requirements while also retaining the properties of a polyester (i.e., suitable stiffness and drape properties, and a high color fastness), there can be obtained a stretch fabric having an excellent overall balance of properties.

[0014]

Here, the properties of a high shrinkage component (high viscosity component) are required to satisfy the above-described coil characteristics. Because the shrinkage properties of the coils are governed by the stretch properties of the high-shrinkage component about the low-shrinkage component, the polymer used in the high-shrinkage component is required to have high extension and high recovery from extension.

[0015]

The inventors have conducted extensive investigations in order to satisfy the above properties without sacrificing the characteristics of the polyester. As a result, they have discovered the use of a polyester consisting primarily of poly(trimethylene terephthalate) (abbreviated hereinafter as "PTT") as the high-shrinkage component.

[0016]

PTT fibers have an exceptional recovery from extension while retaining mechanical and chemical properties comparable with those of such typical polyester fibers as polyethylene terephthalate fibers and polybutylene terephthalate fibers. Apparently, this is because, in the crystalline structure of PTT, the gauche-gauche conformation of the methylene chains (the molecular chains are bent at 90 degrees) in the alkylene glycol portions of the molecule and the low density of points of constraint due to benzene ring interactions (stacking, lateral arrangement) provide a high flexibility which allows for easy extension and recovery of the molecular chain by rotation of the methylene groups.

[0017]

The PTT in the present invention is preferably a polyester in which the primary acid component is terephthalic acid and the primary glycol component is 1,3-propanediol. Other copolymerizable constituents capable of forming ester linkages may also be included in a proportion of preferably up to 20 mol %, and most preferably up to 10 mol %. Illustrative examples of such copolymerizable compounds include dicarboxylic acid compounds such as isophthalic acid, succinic acid, cyclohexanedicarboxylic acid, adipic acid, dimer acids, sebacic acid and 5-sodium sulfoisophthalic acid; and diols such as ethylene glycol, diethylene glycol, butanediol, neopentyl glycol, cyclohexanedimethanol, polyethylene glycol and polypropylene glycol. Other constituents that may be added if necessary include titanium dioxide as a delusterant, finely divided silica or alumina as a lubricant, hindered phenol derivatives as antioxidants, and color pigments.

[0018]

The low-shrinkage component (low-viscosity component) may be any fiber-forming polyester which has a good interfacial adhesion with the PTT serving as the high-shrinkage component and has stable yarnmaking properties. However, from the standpoint of mechanical characteristics, chemical characteristics, and raw material costs, the use of PET capable of being formed into fibers is preferred.

[0019]

For good yarnmaking properties and to achieve dimensional uniformity of the coils in the fiber length direction, it is advantageous for the two components to be used in relative proportions, expressed as the weight percent ratio of high-shrinkage component to low-shrinkage component, within a range of 72:25 to 35:65, and preferably 65:35 to 45:55.

[0020]

The side-by-side bicomponent fiber used in the invention may have a cross-sectional shape that is round, triangular, multi-lobed, flat, peanut-shaped, X-shaped or of any other irregular shape. For example, semicircular side-by-side fibers of round cross-section are desirable for a good balance of crimp developability and hand, hollow side-by-side fibers are desirable for light weight and heat insulation, and side-by-side fibers of triangular cross-sectional are desirable for a dry hand.

[0021]

In the invention, these bicomponent filaments are obtained by blending several types of filaments having differing single filament densities. That is, prior-art fabrics made of unblended filament yarn composed of filaments of uniform linear density have stretch properties, a hand and a gloss that are all uniform and monotonous; only mediocre fabrics can be obtained using such filament yarn. Yarn of a large linear density per filament has a larger stretch power, but a harder hand, whereas yarn of a small linear density per filament has a uniformly limp hand and lacks stiffness, anti-drape and otherwise. Hence, the significance of blending filaments of differing densities.

[0022]

To achieve the objects of the invention, it is preferable for the filaments that are blended together to have single filament linear densities within a range of 0.05 to 15 decitex. At less than 0.05 decitex, the filaments are too fine, resulting in a poor fabric hand and poor dyeability. However, at more than 15 decitex, the resulting fabric has a rough hand. Because neither extreme is desirable for achieving a balance in these properties, it is best for the linear densities to fall within the above-indicated range.

[0023]

No particular limitation is imposed on the number of different filament groups which are blended in the blended filament yarn or on the make-up of the yarn in terms of the linear densities for the respective types of filament therein. However, the blending of 2 to 5 different filament groups is desirable for achieving the objects of the invention and for ease of spinning. To illustrate, here is a specific example of blending carried out using three different filament groups: twenty 1-decitex filaments/ten 3-decitex filaments/four 5-decitex filaments. In this case, the blended filament yarn has an overall linear density for the 34 constituent filaments of 70 decitex, representing an average linear density per filament of 2.1 decitex, and the ratio between the linear densities per filament for the respective types of filament is 1/3/5.

[0024]

The make-up of the filaments in the yarn in terms of linear density can be varied as appropriate for the desired hand and other fabric characteristics. However, to prevent a poor hand and a lack of visual harmony (differences in color and luster), it is preferable to include a large number of small density filaments and a small number of large density filaments. Especially preferred examples of blends of three types of filaments are those obtained by blending filament types having ranges in the relative linear densities per

filament therebetween, expressed in decitex, of (0.7 to 1.2)/(1.5 to 4)/(5 to 12), and having ranges in the number of filaments of each type of (15 to 40)/(14 to 6)/(5 to 22). For thin fabric, the total linear density of these blended filaments is typically set at 30 to 80 decitex. For thick fabric, the total linear density is typically set at 90 to 500 decitex.

[0025]

Blending together more than five types of filaments is undesirable because the resulting fabric tends to acquire a uniform character that makes it ordinary and unexceptional.

[0026]

The method for blending the above filaments is not subject to limitation, and may be either a spin blending process or a process in which the filaments are spun then blended ("post-blending process"). However, a spin blending process is preferred for obtaining a fabric having a good hand, luster and stretch power and for good production efficiency. In spin blending, production can easily be carried out by discharging the respective filaments of different linear density from a single spinneret and bonding them in a side-by-side configuration. In this way, a structural arrangement can be achieved in which filaments having a large linear density per filament are disposed at the center and filaments having a small linear density are disposed on the outside layer, thus enabling the production of a woven or knitted fabric having a soft surface, a hand with anti-drape stiffness ("hari") and stiffness ("koshi"),* a soft luster, and a good balance of stretch properties.

[0027]

From the standpoint of production efficiency, a "post-blending" process in which the respective types of filament are spun independently then blended together during yarn production is possible for blending two or three types of filament. In this case, it is preferable to produce the yarn by core-sheath conjugation with the large linear density filaments as the core and the small linear density filaments as the sheath.

[0028]

Next, with regard to the yarn shape after spinning, the use of the yarn as a textured yarn obtained by drawing the yarn by a conventional method at a draw ratio of about 3 to form drawn yarn or by half-drawing then false-twisting is advantageous from the standpoint of quality.

[0029]

In a thin fabric, using this side-by-side bicomponent fiber in a substantially untwisted or soft twisted state is desirable in terms of the stretch properties and the hand. "Substantially untwisted" refers to a soft twist of up to 500 turns/m, and preferably up to 300 turns/m, imparted to the warp yarns so as to improve the weaving or knitting properties.

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* Translator's Note: The Japanese terms hari and koshi are characteristics of the fabric hand in the Kawabata evaluation system.

[0030]

In a thick fabric, imparting the yarn with a real twist of about 1,000 to 2,000 t/m is desirable for achieving a large fullness.

[0031]

The polyester-type stretch woven or knitted fabric of the invention has an average percent extension of at least 10% and a percent recovery from extension of at least 70%. In the case of woven fabric, the fabric has a percent extension in the longitudinal and/or transverse direction of at least 10%. The "woven fabric percent extension" is a stretch parameter defined under "Measurement Methods" in the Examples section of this specification. At a fabric percent extension of less than 10%, the fabric is unable to follow stretching and contraction of the skin during physical activity by the wearer, making it impossible to achieve satisfactory comfort when worn.

[0032]

Moreover, the woven fabric of the invention must have a recovery from extension of at least 70%. At a woven fabric recovery from extension of less than 70%, the fabric does not recover when worn, causing sagging to occur at the knees and elbows and giving rise to wrinkling, which is undesirable. "Average percent extension" and "average percent recovery," as used herein, refer to averages for the transverse and longitudinal directions of the woven or knitted fabric.

[0033]

In the invention, it is preferable to use such side-by-side bicomponent fibers to account for 100% of the yarn in the fabric, although combination weaving or combination knitting with other fibers is acceptable. In the latter case, to achieve the objects of the invention, it is preferable for the blending ratio of the foregoing bicomponent fibers to be at least 20%.

[0034]

The above-described side-by-side bicomponent fibers may be twisted or blended with other fibers.

[0035]

The resulting yarn is then woven by a conventional method. The use of a water jet or air jet loom to weave thin fabric, and a rapier loom to wave a thick fabric is suitable from the standpoint of stretch stability and quality of appearance. If the fabric to be manufactured is a knitted fabric, knitting at a high gauge for thin fabric and at a low gauge for thick fabric is preferable for similar reasons.

[0036]

The fabric may have any suitable construction, although a twill weave, plain weave or backed weave is preferred if the fabric is woven, and a "smooth" knit, plain knit or mock Milano rib knit is preferred for knit fabric.

[0037]

After weaving or knitting, the fabric is subjected to conventional relaxation heat treatment, alkali reduction treatment, intermediate set, dyeing and finishing. In relaxation heat treatment, for crimping of the side-by-side bicomponent fibers to overcome the constraining forces of the woven fabric and undergo a sufficient degree of development, it is preferable that the liquid temperature be set to at least 80°C. Dyeing is carried out at 130°C using a conventional disperse dye. Conventional electrostatic treatment, water-repelling treatment or coating treatment may be employed for finishing. It is also desirable to add small amounts of smoothing agent and softener in order to achieve better stretch properties.

[0038]

The invention can be employed in a broad range of applications, from thin fabric for blouses, one-piece outfits and shirts, to thick fabrics for slacks, skirts and jackets.

[0039]

Polyester-based woven and knitted fabrics obtained as described above have a combination of excellent comfort when worn, high stretch and high recovery, a soft yet resilient hand and an elegant luster which is not attainable in the prior art.

[0040-0046]

Examples:

Examples are given below by way of illustration. The evaluation methods used in the examples are described below.

Evaluation Methods

(1) Average Percent Extension of Woven Fabric:

Measurements were obtained by method A (constant rate of extension method) for measuring percent extension in JIS L-1096. A higher value indicates greater stretch properties and is desirable. The average percent extension was arrived at by adding together respective percent extension values in the longitudinal direction and the transverse direction of the woven or knitted fabric, and taking one-half of the sum.

(2) Average Percent Recovery from Extension:

Measurements were obtained by method A (constant rate of extension method) for measuring percent recovery from extension in JIS L-1096. A higher value indicates greater stretch properties and is desirable. The average percent recovery from extension was arrived at by adding together the respective percent recovery from extension values in the longitudinal direction and the transverse direction of the woven or knitted fabric, and taking one-half of the sum.

(3) Hand:

The fabric obtained after dyeing and finishing was held in the hands and subjected to sensory evaluation by a panel of ten judges. One of the following three ratings was assigned.

Good: Soft feel, and very good anti-drape stiffness ("hari") and stiffness ("koshi")
Fair: Softness is comparable to that of ordinary woven or knitted fabric
Poor: No softness, anti-drape stiffness ("hari") or stiffness ("koshi")

(4) Hand [sic]*:

The fabric obtained after dyeing and finishing was held in the hands and subjected to sensory evaluation by a panel of ten judges. One of the following three ratings was assigned.

Good: Mild, soft, elegant luster
Fair: Ordinary
Poor: Strong, uniform gloss

Working Example 1

Yarnmaking:

Homo-PTT having an intrinsic viscosity (IV) of 1.40 and homo-PET having an intrinsic viscosity (IV) of 0.60 were each separately melted, then spun together in a compounding ratio (wt %) of 50:50 from a 24-hole spinneret for spinning bicomponent fibers at a spinning temperature of 275°C, discharged as the three filament-type blended filament yarn described below and hauled off at a spinning speed of 1,400 m/min, giving unstretched 196-dtex, 24-filament bicomponent yarn having a side-by-side arrangement. The makeup of the resulting spin-blended yarn in terms of single filament linear densities and number of respective filaments was as follows: twelve 3.3-decitex filaments/eight 9.8-decitex filaments/four 19.6-decitex filaments. Blend spinning was carried out with the small linear density filaments being discharged at the outer layer of the spinneret and large linear density filaments being discharged at the center. Next, using a hot roll/hot plate-type drawing machine (yarn contacting length, 20 cm; surface roughness, 3S), drawing was carried out at a hot roll temperature of 75°C, a hot plate temperature of 170°C and a draw ratio of 3.3. Instead of being hauled off, the yarn was then subjected to relaxation at a ratio of 0.9 and wound up, giving a 66-dtex, 24-filament drawn yarn.

[0047]

The makeup of the drawn blended filament yarn in terms of single filament linear densities and number of respective filaments was twelve 1.1-decitex filaments/eight 3.3-decitex filaments/four 6.6-decitex filaments. (The three types of fiber together had an average linear density per filament of 2.8 decitex, and the ratio between the linear densities per filament for the respective types of filament was 1/3/6.)

* TN: "Gloss" was clearly intended here.

Weaving:

Both the warp yarns and the filling yarns were prepared in the same way. Two of the side-by-side bicomponent filament yarns were twisted together at a twist of 200 t/m. The resulting yarn was woven into a 2/2 twill design at a warp by weft density in the greige fabric of 112×88 yarns/2.54 cm on an air jet loom. The woven fabric had a basis weight of 121 g/m^2.

Dyeing and Finishing:

The resulting greige fabric was relaxation heat treated and dried at 95°C in an open soaper, then intermediate set under dry heat at 180°C, and alkali reduction treated (weight loss, 12%). Next, the fabric was dyed with a blue disperse dye at 130°C for 60 minutes, after which it was finish set on a pin tenter under dry heat at 170°C. The finished roll had a warp by weft density of 141×111 yarns/2.54 cm. The finished fabric had a basis weight of 137 g/m^2.

Comparative Example 1

Aside from using a 100% polyester (PET) 66 decitex, 24 filament unblended drawn yarn composed of only one type of filament (linear density per filament, 2.8 decitex), a finished woven fabric was produced as in Working Example 1.

Comparative Example 2

Aside from using a 100% polytrimethylene terephthalate (PTT) 66 decitex, 24 filament unblended drawn yarn composed of only one type of filament (linear density per filament, 2.8 decitex), a finished woven fabric was produced as in Working Example 1.

Comparative Example 3

Aside from using a 50:50 polytrimethylene terephthalate (PTT)/polyester (PET) side-by-side bicomponent 66 decitex, 24 filament unblended drawn yarn (linear density per filament, 2.8 decitex), a finished woven fabric was produced as in Working Example 1.

Evaluation Results:

The woven fabric obtained in Working Example 1 had an average percent extension of 24% (warp direction, 22%; filling direction, 26%) and an average percent recovery from extension of 88% (warp direction, 86%; filling direction, 90%), and thus exhibited excellent stretch properties. This blue twill weave fabric had a very good hand that was soft yet had anti-drape stiffness ("hari") and stiffness ("koshi") (hand rating: good) and had a soft, elegant luster (gloss rating: good). Examination of the yarn cross-sections in this fabric under a scanning microscope confirmed that filaments of a small linear density were located on the outer layer and filaments of a large linear density were located at the center.

[0048]

The woven fabric obtained in Comparative Example 1 had an average percent extension of 2.4% (warp direction, 2.0%; filling direction, 2.6%), which was entirely unsatisfactory.

[0049]

The woven fabric obtained in Comparative Example 2 had an average percent extension of 6.8% (warp direction, 6.4%; filling direction, 7.2%) and an average percent recovery from extension of 42% (warp direction, 43%; filling direction, 41%). Both these values were less than desirable.

[0050]

The woven fabric obtained in Comparative Example 3 had an average percent extension of 16.3% (warp direction, 16.4%; filling direction, 16.2%) and an average percent recovery from extension of 78% (warp direction, 79%; filling direction, 77%), and thus had good stretch properties. However, it had a hard hand (hand rating: fair) and a uniform and intense gloss (gloss rating: poor), both of which were unacceptable.

[0051]

The woven fabric obtained in Working Example 1 was sewn into a blouse and worn for an extended period of time, in the course of which, as with the woven fabric ratings, it exhibited a comfort, hand and gloss which were all excellent.

Working Example 2

Spinning, Yarnmaking and Knitting:

A 38 decitex, 48 filament side-by-side bicomponent drawn yarn was spun by the same method as in Working Example 1. The makeup of the blended filament yarn in terms of single filament linear densities and number of respective filaments was twenty-four 0.11-decitex filaments/sixteen 0.88-decitex filaments/eight 2.64-decitex filaments. (The three types of fiber together had an average linear density per filament of 0.79 decitex, and the ratio of linear densities per filament for the respective types of filament was 1/8/24.) A twist of 1,000 t/m was applied to the blended filament yarn with a twister, following which the twist was set under steam at 80°C. The twisted yarn was knit into a plain knit fabric at a welt yarn density of 42 yarns/inch and a course yarn density of 40 yarns/inch.

Dyeing:

The knitted fabric was subjected to conventional scouring (120°C hot water) and setting (dry heat at 190°C), following which it was alkali reduction treated in a jet dyeing machine. The weight loss of the knitted fabric was 8%. Next, the fabric was subjected to high-pressure, high-temperature dying at 130°C for 60 minutes with a black disperse dye and finished. The finished fabric had a welt yarn density of 52 yarns/inch and a course yarn density of 48 yarns/inch.

Comparative Example 4

Aside from using a 100% polyester (PET) 38 decitex, 48 filament unblended drawn yarn composed of only one type of filament (linear density per filament, 0.79 decitex), a knitted fabric was produced in the same way as in Working Example 2.

Evaluation Results:

The knitted fabric obtained in Working Example 2 had an average percent extension of 46% (warp direction, 42%; weft direction, 50%) and an average percent recovery from extension of 92% (warp direction, 90%; weft direction, 94%), and thus exhibited excellent stretch properties. This was a wonderful black plain knitted fabric with a very good hand that was soft yet had anti-drape stiffness ("hari") and stiffness ("koshi") (hand rating: good), and had a soft, elegant luster (gloss rating: good).

[0052]

The woven [sic] fabric obtained in Comparative Example 4 had an average percent extension of 6.2% (warp direction, 4.2%; weft direction, 8.2%), indicating a low stretch. In addition, the hand and gloss were both ordinary. Hence, this fabric was entirely unsatisfactory.

Working Example 3

Spinning, Yarnmaking and Weaving:

A 106 decitex, 46 filament side-by-side bicomponent drawn yarn was spun by the same method as in Working Example 1. The makeup of the blended filament yarn in terms of single filament linear densities and number of respective filaments was twenty 0.88-decitex filaments/twenty 2.2-decitex filaments/four 5.5-decitex filaments/two 11-decitex filaments. (The four types of fiber together had an average linear density per filament of 2.3 decitex, and the ratio between the linear densities per filament for the respective types of filament was 1/2.5/6.3/12.5.) Two of these blended component yarns were doubled and twisted on a twister at a twist of 400 t/m, following which the twist was set under steam at 80°C. The twisted yarn was woven on a rapier loom into a warp-backed weave fabric at a warp by weft density in the greige fabric of 88×78 yarns/2.54 cm. The woven fabric had a basis weight of 307 g/m^2.

Dyeing and Finishing:

The resulting greige fabric was relaxation heat treated in a jet dyeing machine at 120°C, dried, then intermediate set under dry heat at 180°C, following which it was alkali reduction treatment (weight loss, 22%). The treated fabric was then dyed with a disperse dye at 130°C for 60 minutes, after which it was finish set on a pin tenter under dry heat at 170°C. The finished roll had a warp by weft density of 110×98 yarns/2.54 cm. The finished fabric had a basis weight of 316 g/m^2.

[0053]

The woven fabric obtained in Working Example 3 had an average percent extension of 29% (warp direction, 28%; weft direction, 30%) and an average percent recovery from extension of 91% (warp direction, 88%; weft direction, 94%). The fabric

surface had a hand that was soft yet of excellent stiffness ("koshi") and resilience (hand rating: good) and also had a soft, elegant luster (gloss rating: good), all indicative of a backed fabric of high quality. The fabric was sewn into a ladies' jacket and worn. This stretch article exhibited outstanding comfort and superb quality fully in keeping with the excellent ratings for the fabric itself.

[0054]

The present invention provides polyester stretch woven and knitted fabrics having a combination of excellent comfort when worn, a high stretch and recovery from stretch, a soft yet resilient hand and an elegant luster which is not attainable in the prior art.

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